Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2013, 5(2):228-230

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Role of soil micro-flora on growth of *Raphanus sativus* cv. newar in Jaunpur city

Preeti Singh

Dept. of Environmental Science, College of Basic Sciences and Humanities, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

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ABSTRACT

*India has shown a remarkable progress in recent years and has attained self sufficiency in food staples. The **radish** (Raphanus sativus) is an edible root vegetable of the Brassicaceae family that was domesticated in Europe in pre-Roman times. In the Jaunpur city of Uttar Pradesh, a variety known newar or jaunpuri is grown which attains enormous size with a length of up to 75-90 cm and a girth of 50-60 cm, and may weigh up to 5-15 kg, or even more. However, this was not conspicuous in another cultivar of radish i.e. pusa chetki growing at the same site. It was found that the physico-chemical properties of irrigated water, soil and microbial population, supported the root growth of newar 112.5% (length), 133.3% (girth) and 2077.5% (biomass) more than that of pusa chetki. Among the two selected sites (M. N. Khan and Siddiquepur), Mandi Nasheeb Khan (experimental site) provided suitable environment for better growth of cv. newar of radish.*

Key words: Pusa chetki, Jaunpuri, Hardness, Electrical Conductivity, Bulk density, soil-microflora.

INTRODUCTION

The existence of agriculture practices in ancient times in India was recorded in some Vedic literature. India's gross irrigated crop area of 82.6 million hectares (215.6 million acres) is the largest in the world. Of a broad range of crops, including wheat, rice, pulses, cotton, peanuts, fruits, and vegetables, India has grown to become one amongst the top three global producers [1]**.**The main enzymes found in radish are phosphatase, catalase, sucrase, amylase, alcohol dehydrogenase and pyruvic carboxylase. Organic acids detected include, p-coumaric, caffeic, ferulic, phenyle pyruvic, gentisic and p-hydroxybenzoic acids [2]. Some lavone compounds are also found in leaves [3]. Sulphoraphene found in radishes are very good for antibacterial activity against *streptococcus, Pyococcus, Pneumococcus* and *Escherichia coli*.

In the Jaunpur city of Uttar Pradesh, a variety known newar or jaunpuri is grown which attains enormous size. When these roots are cultivated elsewhere they do not attain this size [4]. In the experiment it was planned to analyse the impact of soil (chemical and microbial population) and irrigated water on growth of *Raphanus sativus* in the hub of radish grower, Jaunpur district of India.

EXPERIMENTAL SECTION

Two sites viz. Siddiquepur and Mandi Naseeb Khan were selected in periurban of the Jaunpur city. Seeds of the two cultivars of *Raphanus sativus* such as newar and pusa chetki were procured from the research station of Krishi Vigyan Kendra of N.D. University Faizabad. At all the two sites experimental beds (size 1.5 x 2.0) were prepared

for sowing the two cultivars of *Raphanus* (newar as well as pusa chetki) on alternate bunds in October. Seedlings were thinned manually to maintain the interplant distance of 25 cm. The experimental beds were subjected to manure by cowdung and irrigated after every 5 days throughout the experiment. After 90 days growth, the plants were harvested and relevant observations i.e. length, girth and biomass of radish root were monitored. Fortnightly, top soil (0-25 cm depth) and irrigation water were sampled to analyze physico-chemical characteristics following standard protocols. Various dilutions were made from soil samples for microbial isolation by 16S r-RNA.

RESULTS AND DISCUSSION

Changes in data of E.C., pH, hardness, alkalinity and chloride content in water are shown in Table 1. The results revealed that average electrical conductance of the water was found maximum at M. N. Khan (S2 site/experimental site) (3458.5 µS/m) followed by Siddiquepur (S1site /control site) (1343 µS/m).

Table 1: Changes in physico-chemical parameters of water and soil and their correlation with growth of newar and pusa chetki varieties of *Raphanus sativus* at two selected sites

S.N.	Parameters	Siddiquepur (S1)	M.N.Khan (S2)	R^2					
				cv. pusa chetki			cv. newar		
				Length	Girth	Biomass	Length	Girth	Biomass
1.	pH (water)	8.50	7.30	0.09	0.00	0.00	0.27	0.23	0.02
2.	EC (water) (µS/m)	1295.7	3458.5	0.53	0.53	0.37	0.89	0.92	0.66
3.	Hardness (mg/l)	325	808.5	0.53	0.52	0.37	0.89	0.92	0.66
4.	Chloride (mg/l)	95.4	576.6	0.54	0.53	0.38	0.89	0.93	0.67
5.	pH of soil	8.82	8.23	0.01	0.06	0.04	0.09	0.06	0.01
6.	EC of soil	120.8	366.4	0.32	0.79	0.53	0.36	0.44	0.70
7.	Organic carbon (%)	0.57	0.75	0.55	0.82	0.57	0.78	0.86	0.87
8.	Nitrogen (%)	0.028	0.038	0.56	0.80	0.55	0.81	0.89	0.86
9.	Phosphate kg/h	18.0	13.5	0.56	0.77	0.54	0.84	- 0.91	0.85
10	Potassium kg/h	231	176	0.53	0.85	0.58	0.72	0.81	- 0.87

The same trend was followed by average hardness and chloride content. The maximum availability of organic carbon in soil was found at site S2 (0.75%), followed by site S1 (0.57%). Similarly, S2 site was maximally enriched with nitrogen (0.038%), followed by site S1 (0.028%). However, K and P content in the soil were maximum available at site S1.

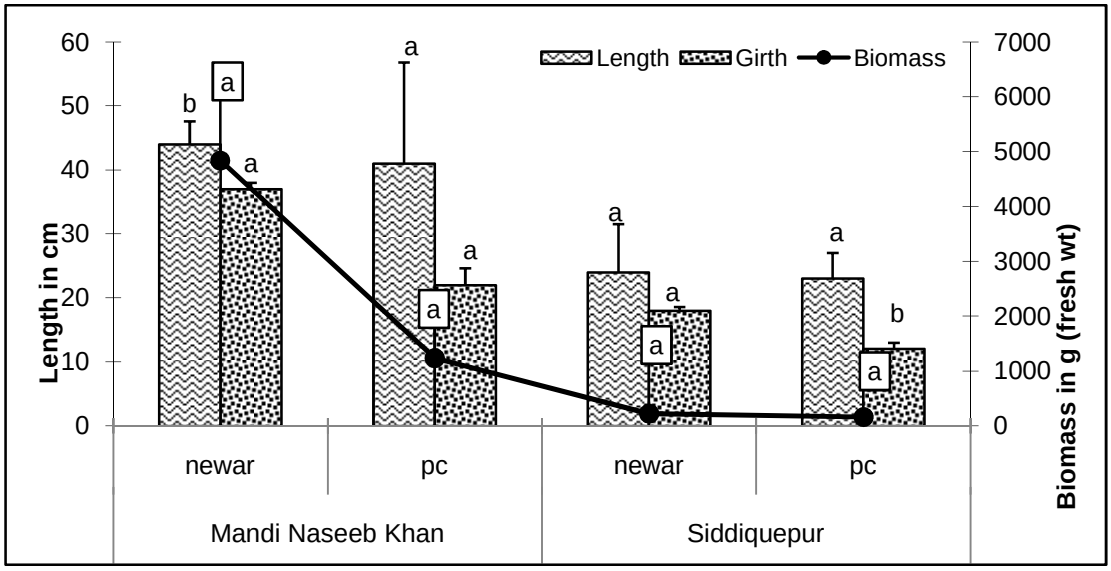

Figure1: Comparison of growth of cv. newar and pusa chetki at two sites

The result obtained after isolation of the microbacteria at both the sites showed that the S2 site was highly enriched with *Acinetobacter calcoaccticus* ($7x10^6$), *Bacillus. cereus* ($4x10^6$ cfu), *B. firmis* (**(**$5x10^6$ cfu), *B. licheniformis* (5x

10^6cfu), *B. megaterium* (8x 10^6 cfu), *B. thuringiensis* (9x 10^6 cfu), *Pseudomonas mendocina* (8x 10^6 cfu), *P. putida* (9x 10^6 cfu) and *Serratia plymuthica* (4x10^6). However, the colonies of *Bacillus sphaericus* (6x10^6) and *Serratia marcescens* (7x10^6) were observed higher at site S1than that of site S2 (Table 2).

Table 2: Microbial community isolated from control as well as experimental site

S.N	Closest species	cfu		% similarity
		Siddiquepur (S1)	M.N.Khan (S2)	
1	*Acinetobacter calcoaccticus*	4 x10^6	7x10^6	96
2	*Bacillus cereus*	2x10^6	4x10^6	100
3	*Bacillus firmus*	2x10^6	5x10^6	99
4	*Bacillus licheniformis*	3 x10^6	5x10^6	99
5	*Bacillus megaterium*	4x10^6	8x10^6	98
6	*Bacillus sphaericus*	6x10^6	3x10^6	97
7	*Bacillus thuringiensis*	6x10^6	9x10^6	97
8	*Pseudomonas mendocina*	5x10^6	8x10^6	97
9	*Pseudomonas putida*	4x10^6	9x10^6	99
10	*Serratia marcescens*	7x10^6	2x10^6	98
11	*Serratia plymuthica*	2x10^6	4x10^6	99

The results depicted that among the various physico-chemical properties of water, EC, hardness and chloride content appeared to be growth supportive at site S2 as the girth of cv. newar was enhanced significantly (R^2 0.92) with increasing these values [5] (Table 1). Likewise, the soil highly enriched with organic carbon and nitrogen enhanced the growth of cv. newar significantly (R^2 0.87) at S2 [6]. However, soil K and P contents were found to be negative correlated with radish growth (R^2 0.87). The growth pattern of both the varieties (newar as well as pusa chetki) at all the two sites was recorded. It was found that length of cv. newar was maximum at site S2 (44cm) followed by site S1 (24cm). Likewise, the pattern of girth and biomass accumulation was maximum at site S2 followed by site S1 (Fig. 1). The colonial density of the isolated microorganisms were higher at site S2 than that of site S1 [7, 8]. However, the colonies of *Bacillus sphaericus* and *Serratia marcescens* reported maximum at S1 site did not show any significant change in the growth pattern.

CONCLUSION

On the basis of experimental results, it is concluded that physico-chemical properties of the soil, irrigated water and some microorganism isolated from S2 site were more favourable for the growth of cv. newar than that of site S1. However, pusa chetki's growth was not promoted by these factors. Such a contrary behaviour of the two varieties of radish could be accounted for the difference in their genetic makeup, which might have acerbated by interaction of environmental conditions.

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